

WHAT IS CLAIMED IS:

1. An optical fiber coupler comprising:

a plurality of optical fibers including a  $\lambda_1$ -band optical fiber and a  $\lambda_2$ -band optical fiber,  
5 fused together at a fusion-elongated portion, wherein, in the fusion-elongated portion,  
each of the plurality of optical fibers tapers to a respective narrower outer diameter,  
relative to an outer diameter of the optical fiber outside the fusion-elongated portion,  
wherein the  $\lambda_1$ -band is different from the  $\lambda_2$ -band, and

10 wherein a propagation constant difference between the optical fibers is  $10^{-4}$  rad/ $\mu\text{m}$  or  
smaller.

2. An optical fiber coupler comprising:

a plurality of optical fibers including a  $\lambda_1$ -band optical fiber and a  $\lambda_2$ -band optical fiber,  
fused together at a fusion-elongated portion, wherein, in the fusion-elongated portion,  
15 each of the plurality of optical fibers tapers to a respective narrower outer diameter,  
relative to an outer diameter of the optical fibers outside the fusion-elongated portion,  
wherein the  $\lambda_1$ -band is different from the  $\lambda_2$ -band, and

wherein at least outside the fusion-elongated portion, the  $\lambda_1$ -band optical fiber is a  
single mode optical fiber at a wavelength in the vicinity of 0.98  $\mu\text{m}$ ,

20 wherein at least outside the fusion-elongated portion, the  $\lambda_1$ -band optical fiber  
comprises a first core, a second core surrounding the first core and having a radius  
within the range of 10  $\mu\text{m}$  or greater, and a cladding surrounding the second core, and  
wherein a relative refractive-index difference of the second core and the cladding is  
0.1 % or smaller.

25 3. An optical fiber coupler according to claim 2, wherein a relative refractive-index  
difference of the first core and the cladding is within a range from 0.7 % to 0.9 %.

4. An optical fiber coupler according to claim 3, wherein the  $\lambda_2$ -band optical fiber is a  
30 single mode optical fiber at a wavelength in the vicinity of 1.55  $\mu\text{m}$ .

5. An optical fiber coupler according to claim 2, wherein a relative refractive-index difference of the first core and the cladding is within a range from 0.6 % to 0.8 %.

5 6. An optical fiber coupler according to claim 5, wherein the  $\lambda_2$ -band optical fiber is a single mode optical fiber at a wavelength in the vicinity of 1.55  $\mu\text{m}$ .

7. An optical fiber for an optical fiber coupler comprising:

a first core;

10 a second core surrounding the first core and having a radius within the range of 10  $\mu\text{m}$  or greater; and

a cladding surrounding the second core,

wherein a relative refractive-index difference of the second core and the cladding is 0.1 % or smaller, and

15 wherein the optical fiber for the optical fiber coupler is a single mode optical fiber at a wavelength in the vicinity of 0.98  $\mu\text{m}$ .

8. An optical fiber for an optical fiber coupler according to claim 7, wherein a relative refractive-index difference of the first core and the cladding is within a range from 0.7 %  
20 to 0.9 %.

9. An optical fiber for an optical fiber coupler according to claim 7, wherein the refractive-index difference of the first core and the cladding is within a range from 0.6 % to 0.8 %.

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10. An optical fiber coupler comprising:

a  $\lambda_1$ -band optical fiber having a first core with a radius of  $r_1$ , a second core with a radius of  $r_2$  surrounding the first core, and a cladding surrounding the second core;

a  $\lambda_2$ -band optical fiber including a core with a radius of  $r_3$ , and a cladding surrounding

30 the core; and

a fusion-elongated portion where the  $\lambda_1$ -band optical fiber and the  $\lambda_2$ -band optical fiber are fused together, each of the optical fibers in the fusion-elongated portion tapering to a respective narrower outer diameter, relative to an outer diameter of the optical fibers outside the fusion-elongated portion,

5 wherein the  $\lambda_1$ -band is lower in wavelength than the  $\lambda_2$ -band, and  
wherein  $r_1 < r_3 \leq r_2$ .

11. An optical fiber coupler according to claim 10, wherein a propagation constant difference between the  $\lambda_1$ -band optical fiber and the  $\lambda_2$ -band optical fiber is  $10^{-4}$  rad/ $\mu\text{m}$  or smaller.

12. An optical fiber coupler according to claim 10, wherein a relative refractive-index difference of the second core and the cladding of the  $\lambda_1$ -band optical fiber is 0.1 % or smaller.

15 13. An optical fiber coupler according to claim 10, wherein a relative refractive-index difference of the first core and the cladding of the  $\lambda_1$ -band optical fiber is within a range from 0.7 % to 0.9 %.

20 14. An optical fiber coupler according to claim 10, wherein said  $\lambda_1$ -band optical fiber is a single mode optical fiber at a wavelength in the vicinity of 0.98  $\mu\text{m}$ , and said  $\lambda_2$ -band optical fiber is a single mode optical fiber at a wavelength in the vicinity of 1.55  $\mu\text{m}$ .